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INTELLUFAX 29

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WROUGHT ALUMINUM ALLOYS

Tensile Properties of M206 and Extruded Bars of Sintered Aluminum Powder at Room and Elevated Temperatures

The following comparison between M206, a new conventional type aluminum alloy, and two different alloys of extruded sintered aluminum powder at room and elevated temperatures clearly shows the superiority of both the SAP alloys over this new superior conventional type alloy. 25X1A8a

M206 is a new development alloy and preliminary tests indicate that it is superior to any present alloy; for instance, M206 at 600°F has a tensile strength of over 15,000 psi compared to 7,500 psi for 14ST.

The two extruded sintered aluminum powder alloys listed are M257 and SAP. The main difference between these two materials is the oxygen content, M257 contains approximately 6% Al_2O_3 while SAP has 15% Al_2O_3. The higher oxygen allows for higher strength but is more difficult to work. The M257 used for these tests was supplied by the Aluminum Company of America and the SAP was purchased from Switzerland.

Alloy	Exposure Temp.	Time @ Temp.	Testing Temp.	Y.S. .002"/"	T.S.	% Elong.
M206	—	—	Room	41,000	58,350	15.
M257	—	—	Room	28,000	41,000	18.
SAP	—	—	Room	38,000	52,000	12.5
M206	600°F	100 Hrs.	Room	18,500	38,500	19.
M257	600°F	100 Hrs.	Room	26,000	40,000	19.
SAP	600°F	100 Hrs.	Room	39,000	52,000	10.
M206	600°F	100 Hrs.	600°F	11,500	15,700	20.
M257	600°F	100 Hrs.	600°F	15,000	16,500	8.
SAP	600°F	100 Hrs.	600°F	20,500	23,350	2.
M206	750°F	100 Hrs.	Room	9,500	30,000	18.
M257	750°F	100 Hrs.	Room	26,500	39,250	18.
SAP	750°F	100 Hrs.	Room	38,500	51,000	12.5
M206	750°F	100 Hrs.	750°F	3,700	4,100	30.
M257	750°F	100 Hrs.	750°F	13,000	14,000	8.
SAP	750°F	100 Hrs.	750°F	18,000	18,500	1.
M206	900°F	100 Hrs.	Room	11,000	34,000	22.
M257	900°F	100 Hrs.	Room	26,000	39,250	19.
SAP	900°F	100 Hrs.	Room	36,500	51,000	12.
M206	900°F	100 Hrs.	900°F	2,100	2,500	35.
M257	900°F	100 Hrs.	900°F	11,500	12,000	2.
SAP	900°F	100 Hrs.	900°F	13,300	14,750	1.

It may be readily seen that the extruded bars of sintered aluminum powder are superior for applications above 600°F but that M206 is competitive with M257 at 600°F.

Creep and stress rupture tests on these materials are underway.

Mechanical Properties of Magnesium-Rare Earth Alloys

The tensile data obtained thus far on the magnesium-thorium alloy HK31 is listed below.

Exposure Temp. °F	Exposure Time Hrs.	Testing Temp. °F	Y.S. .002"/"	T.S.	% Elong.
300	100	Room	15,000	20,500	1.
300	100	300	11,500	18,300	8.
400	100	Room	16,000	21,000	2.
400	100	400	14,000	18,000	17.
500	100	Room	17,500	29,000	3.
500	100	500	13,000	22,200	15.
600	100	Room	15,000	23,000	4.
600	100	600	9,000	15,000	22.

Preliminary stress rupture data on the magnesium-rare earth alloys has been obtained and is listed below.

	400°F		500°F	
Alloy	100 Hrs.	1000 Hrs.	100 Hrs.	1000 Hrs.
EK30AT5	12,500	9,600	6,500	5,000
EK30AT6	12,500	9,200	6,000	4,500
HK31AT5	18,000	15,000	11,000	9,000
HK31AT6	21,000	18,000	14,000	12,500
EZ33AT5	15,000	11,000	7,500	5,500

The superiority of HK31, the magnesium thorium alloy, over the magnesium-cerium alloys is readily apparent. This alloy looks very encouraging thus far and may eventually be used in place of aluminum. The chief obstacles to this alloy at present are the lack of production experience and the fact that they are approximately 200 to 300% more expensive than the conventional magnesium casting alloys. The Dow Chemical Company has informed us that the supply of thorium is plentiful for aircraft applications and that they are anxious and willing to furnish castings in this alloy.

CAST ALUMINUM ALLOYS

The tensile properties of cast aluminum alloys currently under test at the River Works have been obtained and the table below lists the values at room temperature and at 600°F after unstressed exposure for 100 hours at 600°F.

		Room Temperature			At 600°F (100 Hrs. @ Temp.)		
Alloy	Base	Y.S.	T.S.	El.	Y.S.	T.S.	El.
355-T51	Al	23,000	28,000	1.5	5,400	8,000	19
355-T6	Al	33,000	39,000	2	4,900	7,350	32
RRX99-T6	Al	23,000	40,000	2	10,700	14,200	11
142-T77	Al	43,000	44,000	1	10,000	14,400	12
Almag 35-F	Al	20,000	33,000	10	10,600	14,500	17
RR53-T6	Al	40,000	44,000	1	9,000	12,000	12
NACA 1444-T6	Al	27,500	34,000	1	11,500	16,300	15
RAE55-T6	Al	22,000	29,000	0.5	9,500	14,000	3
ML-T6	Al	37,500	40,000	0.5	14,000	18,000	5
A355-T6	Al	30,000	38,000	1.5	6,500	9,000	15.5

The following preliminary stress rupture data at 300°F has been obtained. The tests at 400, 500, and 600°F are underway and results will be forthcoming shortly.

Alloy	100-Hr. Strength @ 300°F	Elongation
RR53-T6	23,000	3-4
NACA 1444-T6	23,000	2
DCK2-T6	23,000	2
RAE55-T6	25,000	-
ML-T6	▷ 25,000	-
142-T6	▷ 25,000	-
RRX99-T6	22,000	4
Almag 35-T6	22,000	7-8
A355-T6	▷ 25,000	-

The better aluminum alloys reported in general do not have castability as good as 355, the alloy used at present. A355 and RRX99 are the best casting alloys of all the above, and these alloys appear to have inferior thermal stability to the ML and 142 type alloy.